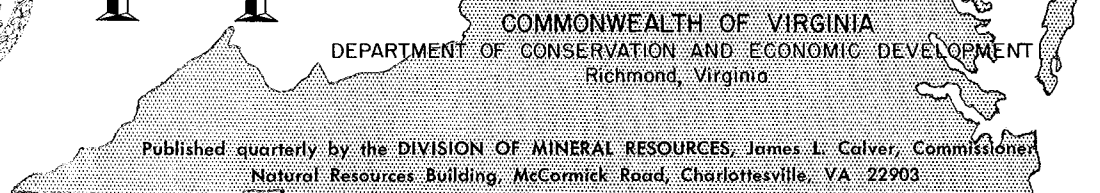


VIRGINIA



MINERALS



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THE MINERAL INDUSTRY OF VIRGINIA IN 1968¹

Due in large measure to a record-breaking output of coal, together with a moderately higher average unit value for this commodity, the total value of 1968 mineral production in Virginia rose to a new high of \$295.7 million, 4 percent greater than the \$283.7 million reported in 1967, the previous record high value year. With the exception of stone, which declined slightly in output, the production of commodities supplying the construction industries—cement, clays, gypsum, and sand and gravel—was moderately greater in 1968. Mineral fuels produced in the State in addition to coal included natural gas and limited quantities of oil; production of mineral fuels is confined to southwestern counties. Other mineral commodities produced included aplite, cement (portland and masonry), clays, feldspar, gem stones, gypsum, kyanite, lime, iron ore (pigment material), lead and zinc ore, titanium concentrates (ilmenite and rutile), salt, sand and gravel, and stone (including soapstone and marine shell). Of the total 1968 value of mineral production, 64 percent was contributed by fuels and metals, with fuels by far the largest contributor, and 36 percent by non-metals.

While Virginia coal production reached an all-time high of 37 million tons in 1968, coal mining employment declined about 5 percent from the 11,000 workers employed in 1967. Declining mine

employment is a long-established trend resulting from the continuing mechanization of coal mines. However, several new mines now under construction in the coal area of southwestern Virginia are expected to help offset the current decline in mine employment when in production. Coal mining is by far the most important section of Virginia's mining industry, accounting for about three-quarters of all mine employment.

Plans were announced in 1968 by Virginia Electric and Power Company to build a nuclear power generating station on the North Anna River in Louisa County. The proposed project, which will be known as the North Anna Power Station, reportedly will have an ultimate capacity of 4 million kilowatts. This facility will be the company's second nuclear power generating plant; a 1.6 million kilowatt station is under construction in Surry County on the James River. An 11,000-acre lake to provide cooling water for the proposed facility will be created by damming the North Anna River near Smiths Mill Bridge and will extend into parts of Louisa, Spotsylvania, and Orange counties. A series of canals and lagoons on adjoining company property will cool the effluent before the water is returned to the lake from which it was initially pumped. Ultimately, development of the project is expected to create a large recreational area. Also in 1968 the company announced it had filed application with the Federal Power Commission to construct a 1-million-kilowatt pumped hydroelectric project on the Calf-pasture River and Little Mill Creek in Rockbridge,

¹ Prepared by the Bureau of Mines, U. S. Department of the Interior, under a cooperative agreement with the Virginia Division of Mineral Resources for collecting information on all minerals except fuels.

Table 1.—Mineral production in Virginia.¹

Mineral	1967		1968	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays thousand short tons	1,382	\$1,623	1,462	\$1,714
Coal (bituminous) do	36,721	171,183	36,966	178,946
Gem stones	NA	7	NA	7
Lead (recoverable content of ores, etc.) short tons	3,430	960	3,573	944
Lime thousand short tons	829	10,345	919	11,138
Natural gas million cubic feet	3,818	1,149	3,389	1,013
Petroleum (crude) thousand 42-gallon barrels	3	W	3	W
Sand and gravel thousand short tons	9,863	12,494	10,859	13,644
Soapstone short tons	W	W	3,928	10
Stone thousand short tons	31,324	52,470	31,217	53,533
Zinc ² (recoverable content of ores, etc.) short tons	18,846	5,088	19,257	5,199
Value of items that cannot be disclosed:				
Aplite, cement (portland and masonry), feldspar, gypsum, iron ore (pigment material), kyanite, salt, titanium concentrate (ilmenite and rutile), and data indicated by symbol W				
	—	28,366	—	29,515
Total	—	\$283,685	—	\$295,663
Total 1957-59 constant dollars	—	\$295,193	—	p\$296,623

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data.

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

² Recoverable zinc valued at the yearly average price of prime western slab zinc, East St. Louis market. Value established after transportation, smelting, and manufacturing charges have been added to the value of ore at the mine.

Augusta, and Bath counties. The project, to be called Marble Valley, is scheduled for operation in early 1975.

Mineral Fuels

Coal (Bituminous).—Coal, the most important mineral commodity produced in Virginia, accounted for 60.5 percent of the value of the State's mineral production in 1968, compared to 60.3 percent in 1967. Coal production increased in three of the eight coal-producing counties and rose to 37 million short tons valued at \$179 million and established 1968 as the peak year in both output and value. Mine output was 245,000 short tons (1 percent) greater, and output value was 4 percent higher than in 1967, the previous record output and value year. The greater than proportional increase in output value of coal was due to an average increase of \$0.18 per ton in 1968. Production data includes coal produced from deposits within Virginia, whether the mine opening is, or is not, inside the State boundary and excludes operations producing less than 1000 tons per year. Consequently, production data published by the Federal Bureau of Mines may differ somewhat from data published by the State.

Both high- and low-volatile bituminous coals

were produced for electric power generation, industrial and domestic heating, other industrial uses, coke feedstock, and export. A small quantity of semianthracite coal, mined in Montgomery County, was produced for domestic heating. Four of the eight southwestern counties in which coal was mined—Buchanan, Dickenson, Wise, and Russell—accounted for 96 percent of the total output, compared with 97 percent in 1967. Buchanan County, where 59 percent of Virginia's coal mines were active, accounted for 43 percent of the output in 1968.

The State's record-breaking coal production was achieved with 109 fewer mines of all types than in 1967. Underground production comprised 85 percent of the total output, 2 percent more than in 1967, and 900,000 additional tons of coal were mined with 126 fewer underground mines than the 784 active in 1967. Of the remaining coal output, 11 percent was from strip mines and 4 percent was from auger mines.

Coal was produced by underground mines in all of the eight coal-producing counties and also by strip and auger mines in six counties. In order of output, Buchanan, Dickenson, Wise, and Russell counties led in underground mine tonnage; Wise, Dickenson, and Buchanan counties in strip-mine output; and Buchanan, Wise, and Dickenson coun-

ties in auger-mine production. The average value per ton for underground-mined coal was \$5.07; for strip-mined coal, \$3.55; for auger-mined coal, \$3.48; and for the combined output by all three mining methods, \$4.84.

Of the total underground output, 86 percent was mechanically loaded, 6 percent higher than in 1967. These increases reflected the trend toward modernization and mechanization in the State's underground mines. A total of 335 mobile machines (19 more than in 1967) accounted for 57 percent of the mechanically loaded tonnage; 98 continuous mining machines (4 more than in 1967) accounted for 38 percent; long-wall machines and hand-loaded face conveyors accounted for the remainder. Of the total coal mined, 53 percent was mechanically cleaned in 33 plants. Wet washing, other than with jigs, was the principal method of cleaning and accounted for 87 percent of the cleaned coal. Of the cleaned coal, 49 percent was thermally dried. Of the total coal mined, 36 percent was crushed. Fourteen percent of the total coal output was treated with dust-allaying and antifreezing preparations, of which oil predominated (98.5 percent).

Coke.—Coal was converted to coke in beehive and Mitchell-type ovens; no byproduct recovery was made. In 1968 coke was produced in three plants (three companies), one in Buchanan County and two in Wise County. The State's total capacity was substantially lower in 1968 due to three plant shutdowns in Wise County in 1967.

Petroleum and Natural Gas.—Natural gas production data in Table 1 are reported to the Bureau of Mines by pipeline companies and are not necessarily comparable with data reported by State agencies. The production of natural gas for commercial use was 3389 million cubic feet, 11 percent less than that of 1967. The output was delivered to the pipelines of Atlantic Seaboard Corporation, Consolidated Gas Supply Corporation, and the Kentucky-West Virginia Gas Company. According to the Virginia Department of Labor and Industry, Division of Mines and Quarries, natural gas was produced in four southwestern counties—Tazewell (1963 million cubic feet), Buchanan (908 million cubic feet), Dickenson (508 million cubic feet), and Wise (10 million cubic feet). At the close of the year, 111 gas wells were operating, compared with 112 in 1967. Reserves of natural gas were 34,341 million cubic feet, as reported by The American Gas Association. This is 3457 million cubic feet less than reported in

1967. There were no facilities for the underground storage of natural gas in Virginia; however, the Washington Gas Light Company operated a mined-granite facility in Fairfax County for the storage of liquefied petroleum gases.

During 1968, production of crude petroleum in Virginia totaled 2583 barrels, compared with 3491 barrels in 1967. All production was from Lee County, with the Rose Hill field accounting for 1688 barrels and the Ben Hur field for 895 barrels. At year end, five oil wells were operating, compared with four at the close of 1967.

Nonmetals

Aplite.—Output of aplite decreased substantially, but the value decline was less severe because of a higher average unit value in 1968. Production of this commodity, chiefly for use in glass making, was from two operations, one in Nelson County and one in Hanover County. A limited quantity of the material was produced from quarries in Nelson and Amherst counties chiefly for use as an aggregate.

Cement.—Reversing a declining trend, sales of portland cement increased in 1968. Both shipments and value rose 6 percent. Shipments of masonry cement rose 5 percent, but the value declined 5 percent due to an average decrease of \$0.33 per barrel compared to 1967. Of the total cement shipped, including portland and masonry, portland cement accounted for 88 percent of shipments and 84 percent of the total value.

Portland cement plant capacity was virtually unchanged during the year. Four plants manufactured cement; two of these made both portland and masonry cement, one produced only portland cement, and one plant produced only masonry cement. The wet process of manufacturing portland cement was used by one plant while two plants used the dry process. During 1968, cement was produced in Augusta, Botetourt, and Warren counties and in the city of Chesapeake; the facility in Augusta County reportedly ceased operations at year end. Cement producers mined low-magnesian limestone, shale, clay, and calcareous marl for their own use. Ingredients purchased for use in cement manufacture included sand, oystershell, mill scale, gypsum, various air-entraining compounds, and a variety of grinding aids.

General-use and moderate-heat types (Types I

and II) comprised the bulk of portland cement produced and marketed; a limited quantity of high-early-strength cement (Type III) was produced and shipped. Both air-entrained and non-air-entrained types were produced; the latter accounted for most of the output. Most of the shipments were in bulk, and by railroad, but sizeable shipments were also made by truck. Shipments of cement in containers (94-pound paper bags) were sizable and were made by railroad and truck.

Distribution of portland cement for the various consumer uses in 1968 was as follows: 58 percent to ready-mixed concrete companies (58 percent in 1967); 18 percent to concrete-products manufacturers (18 percent in 1967); 11 percent to contractors, including highway contractors (13 percent in 1967); and 13 percent to other users, including building-material dealers, Federal, State and local government agencies, and miscellaneous customers (11 percent in 1967). Seventy percent of portland cement shipments terminated within the State; the remainder, in order of decreasing shipments, went to North Carolina, West Virginia, South Carolina, and Maryland. Masonry cement shipments went to 31 states, chiefly Virginia, North Carolina, Maryland, South Carolina, and District of Columbia; 62 percent of the shipments terminated in Virginia.

Clays.—Sharing in the relatively mild increase in building activity, both output and value of clay rose 6 percent. Sixty-seven percent of the clay and shale output was consumed in brick manufacture, compared with 68 percent in 1967. The principal uses for the balance of clay and shale were as lightweight aggregate and in the manufacture of portland cement. Some was also consumed in the making of vitrified sewer pipe, flue linings, pottery, clay dummies (shot-hole tampers), and other clay products. Clay production was reported from 21 pits in 15 counties. In order of output, the chief producing counties were: Botetourt, Russell, Chesterfield, Orange, and Nansemond; in order of output value they were Orange, Botetourt, Prince William, Nansemond, and Chesterfield. Five counties produced nearly two-thirds of the State's output, and five accounted for three-quarters of the value.

Feldspar.—Output was greater than in 1967, but the total value declined moderately due to a lower average market value. One company produced feldspar from two mines in Bedford County. Mixed feldspar (soda and potash) was mined near the company's processing and grind-

ing mill in Bedford. The mill output was used chiefly for pottery and ceramic enamel manufacture.

Gem Stones.—Mineral collectors and hobbyists collected a variety of semiprecious gems and mineral specimens in various areas in Virginia.

Gypsum.—Output and value for crude gypsum rose 4 percent. The raw gypsum mined at Plasterco, Washington County, was calcined or otherwise processed and manufactured into plasterboard and other gypsum products by United States Gypsum Company at its Plasterco plant. The company also processed imported gypsum at a plant in Norfolk for use in their products.

Kyanite.—Virginia continued to be North America's leading producer of kyanite. While output of the crude ore and of the refined kyanite declined moderately, average value of the processed material increased moderately. Shipments were primarily to manufacturers of refractories and other ceramic products. Two mines and three processing plants were operated by one company in adjacent Buckingham and Prince Edward counties. The company also operated a grinding and bagging plant in the latter county. Only a small part of the beneficiated kyanite (Al_2SiO_5) is used in the raw state; the bulk of production is calcined to mullite, one of the most important refractory materials used in the ceramic industry. Quartz sand, recovered during the processing of kyanite, was marketed by a subsidiary organization for industrial and construction applications.

Lime.—All-time highs in production and value of lime were set in 1968; lime output and value were 11 and 8 percent greater, respectively, than last year, and exceeded the previous record year (1965) by 8 percent in output and 5 percent in value. Largely responsible for the gain in output was the increasing demand for industrial lime by the chemical and allied industries, especially for use in the rapidly growing basic oxygen steel-making process. Compared with 1967, the outputs were greater for all uses of lime. The output value decreased moderately for agricultural lime, but increased moderately for building and industrial lime, notwithstanding lower average unit values for all uses in 1968. All but 4 percent of the lime sold or used, including both quicklime and hydrated lime, was consumed in chemical, metallurgical, or other industrial use. Primary lime production was reported by ten companies from six counties and one independent

city. Maintaining this order since 1962, Giles, Smyth, and Shenandoah counties were the chief producing areas, in order of output and value, and accounted for 85 percent of the State's 1968 lime output.

Processing equipment used in lime making included pot, shaft, and rotary kilns and batch and continuous hydrators. Raw materials included high-calcium limestone (predominantly), dolomitic limestone, and oystershell. Approximately 1.8 million tons of limestone were calcined to produce the total lime output. Fuels included bituminous coal, coke, and natural gas. Virtually the entire output was high-calcium lime, of which 93 percent was used or marketed as quicklime and the remainder as the hydrated product. Uses for lime were in the manufacture of alkalies, calcium carbide, and paper; as a flux in steel-making and electrometallurgical operations; in sewage and trade-wastes treatment; in the purification and treatment of water; for agricultural purposes and leather tanning; for construction; and in miscellaneous applications. Of the State's output, 36 percent was sold or used within Virginia and the remainder was shipped principally to Pennsylvania, Kentucky, Ohio, West Virginia, North Carolina, Maryland, South Carolina, Wisconsin, and Georgia.

Salt.—Chlorine, caustic soda, soda ash, and other chemicals were produced by Olin-Mathieson Chemical Corporation, Saltville, Smyth County, using brine recovered from nearby captive salt wells. Production of salt was moderately higher than in 1967.

Sand and Gravel.—Mildly heightened building activity in Virginia in 1968 increased the demand for sand and gravel as construction aggregates; sand and gravel rose 10 percent in output and 9 percent in value. Commercial output comprised over 99 percent of total production and value; the remainder was State and local government output, mainly for use in highway maintenance. Of the commercial production, 85 percent was used as coarse and fine construction aggregates in building (40 percent) and paving (45 percent).

Sand comprised 60 percent of the commercial sand and gravel output and 51 percent of the total commercial value. While less than one-tenth of the sand output was marketed as special industrial silica sands used for glass making, engine sand, filler, and other non-construction

uses, almost two-tenths of the value of sand output was attributed to these market uses.

Eighty-six percent of the total commercial sand and gravel output was screened, washed, or otherwise processed. Eighty-five commercial sand and gravel operations were reported in 1968, compared to 78 in the previous year. Of these 85 operations, 58 processed their output at 40 stationary, 15 portable, and 3 dredging installations. The remaining 27 operations recovered unprocessed or bank-run material. Fifty-seven percent of the commercial tonnage was shipped by truck and most of the remainder by rail or water; a small quantity was used captively or transported by unspecified methods.

Production of sand and gravel from all operations was reported from 38 counties and 1 independent city. In order of output the principal sand-and-gravel-producing areas were: Henrico and Fairfax counties, the independent city of Virginia Beach, and Chesterfield, Prince George, and Charles City counties. Over three-fourths of both the total output and value were contributed by these six producing areas. Forty-one of the 85 commercial sand and gravel operations had an annual output range of up to 50,000 tons and accounted for 7.4 percent of the total commercial output, 39 had an output range of 50,000 to 500,000 tons and accounted for 57.2 percent, 4 had an output range of 500,000 to 1,000,000 tons and accounted for 24.2 percent, and 1 had an output range of over 1,000,000 tons and accounted for 11.2 percent. The bulk of sand and gravel recovery was by dredging and open-pit mining; a sizable tonnage of industrial silica sand was produced from crushed sandstone and quartzite, and a limited amount was obtained in the processing of kyanite.

Soapstone.—Crushed and ground soapstone was produced by Blue Ridge Talc Company, Inc., near Henry, principally for use in insecticides and foundry facings. Output and value increased moderately. Soapstone used as a dimension stone is included with miscellaneous stone in the following section.

Stone.—Ranking next to coal in importance to the mineral economy of Virginia, stone accounted for 18 percent of the total value of mineral production in 1968. Total stone output declined slightly, but value rose 2 percent compared to 1967. Substantially higher prices received for

dimension stone (principally soapstone) and a slight increase in the average unit value of crushed stone were responsible for the rise in total stone value.

Varied types of stone were mined or quarried in the State; in order of output value they were limestone (including dolomite), granite, traprock (basalt and diabase), miscellaneous stone (including amphibolite, schist, soapstone, and "Virginia Greenstone"), slate, sandstone (including quartzite and quartz), calcareous marl, and marble. Both crushed or broken stone and dimension stone were produced. Marine shell (oyster-shell) produced as a coproduct of oyster processing was used in the manufacture of lime.

Crushed stone was produced from all the stone varieties and comprised virtually all of the total stone output (99.8 percent) and the major share of the total value (90.6 percent). Of the total crushed stone output, 73 percent or 22.9 million tons was used for building purposes (concrete aggregate and roadstone), the same percentage and tonnage as in 1967. In addition, 13 percent was used in cement and lime manufacture (limestone and calcareous marl), 4 percent was used as agricultural dressing (limestone, dolomite, and calcareous marl), 1 percent was used as fluxstone (limestone), and the remainder as railroad ballast, riprap, stone sand, and in miscellaneous and unspecified applications. Crushed stone declined slightly in output and gained slightly in value, compared with 1967. Despite a 2-percent decline in limestone and dolomite output, value increased 2 percent in 1968. Increases in output and value were reported for traprock (basalt and diabase), granite, and miscellaneous stone; decreases were reported for calcareous marl, marble, sandstone, and slate.

Dimension stone, in order of value, was produced from miscellaneous stone, slate, diabase, sandstone, and limestone. Miscellaneous stone gained only 3 percent in output, but jumped 23 percent in value mainly due to higher prices received for dimensioned soapstone products in 1968. Laboratory and architectural stone and flagging were the principal products derived from soapstone, the most important miscellaneous stone type. Other miscellaneous stone types produced as dimensioned products included "Virginia Greenstone," amphibolite, and schist. Slate declined moderately in both output and value; lower prices for fabricated slate products were reflected in a greater than proportional value

decline. The dimension slate found application as roofing material and for structural and sanitary use, wall facing, and flooring tile. While a low-output commodity in terms of tonnage, dimension stone accounted for 9.4 percent of the total stone output value.

Commercial stone production, including marine shell, was reported from 54 counties and two independent cities. In terms of output, the principal stone-producing counties were: Botetourt (crushed limestone), Goochland (crushed granite), Loudoun (crushed diabase), Augusta (crushed limestone and quartzite), and Frederick (crushed limestone). In terms of product value, the most important counties were: Loudoun (crushed diabase), Botetourt (crushed limestone), Giles (crushed limestone), Nelson (dimension and crushed miscellaneous stone), and Buckingham (dimension slate and crushed slate and quartzite). Thirty-one percent of the total stone output was contributed by five counties, and five counties accounted for 30 percent of the output value.

In 1968, production of limestone (including dolomite) was reported from 26 counties, granite from 17, basalt (including diabase) from 7, miscellaneous stone from 2, slate from 1, sandstone (including quartz and quartzite) from 13, calcareous marl from 2, and marble from 1. In addition, production of miscellaneous stone was reported from one independent city, and one independent city reported production of oystershell. Eleven counties produced more than 1 million tons of stone each, and 19 counties had output valued in excess of \$1 million each. Crushed stone was produced in all the counties reporting stone output. Dimension stone was produced in five counties and in one independent city. Commercial production of stone accounted for over 99 percent of total stone output and value.

Metals

Iron Ore (Pigment Material).—Natural iron oxide pigments were produced by one firm at Hiwassee, Pulaski County, from local deposits of earthy forms of hydrous and anhydrous iron oxides including ocher, sienna, and umber. Manufactured iron oxides, also for use in pigment manufacture and for other purposes, were produced at the company's Pulaski facilities. Natural iron oxide pigments were also produced by a firm at Henry, Henry County, from out-of-State

hematite. The finished iron oxide pigments are used in fertilizers, as foundry facings, in cement, printing inks, and paint manufacture, and in other products. Total marketed output of both natural and manufactured finished iron oxide pigments was substantially less than in 1967.

Lead and Zinc.—Production of crude zinc ore, from two mines in Wythe County operated by one company, was slightly greater than in 1967. The ratio of zinc recovery to that of lead was about 5.39 to 1. In 1968 lead output was 4 percent greater but the value declined slightly. Zinc output and value rose 2 percent.

Titanium Concentrates.—Marketed production of titanium concentrates (ilmenite and rutile) decreased. Ilmenite, which comprised the bulk of marketed production, declined moderately in output and slightly in value; rutile dropped sharply in both output and value. Both ilmenite (FeTiO_3) and rutile (TiO_2) are used in the manufacture of titanium dioxide pigments. Rutile also is used as welding-rod coating. Ilmenite was produced by one firm in Amherst County. The production and marketing of both ilmenite and rutile by another firm in Hanover County were discontinued in the summer of 1968.

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AEROMAGNETIC SURVEY OF SOUTHERN VIRGINIA AVAILABLE

An aeromagnetic survey that covers approximately 3450 square miles in southern Virginia and includes all or portions of Mecklenburg, Brunswick, Lunenburg, Prince Edward, Charlotte, Halifax, Pittsylvania, Henry, Franklin, and Floyd counties is now available from the Division of Mineral Resources. Magnetic variations were recorded on an airborne magnetometer at an altitude of 500 feet above ground level. Basic traverses were flown in east-west lines with one-half mile spacing between adjacent traverses; control lines were flown at right angles to these.

The data are compiled on maps at a scale of 1:62,500, or 1 inch equals approximately 1 mile, and total magnetic intensity is contoured at in-

tervals of 20 and 100 gammas. U. S. Geological Survey topographic quadrangle maps were used as bases, and the following 15-minute quadrangles are included: all of Kenbridge, Chase City, Clover, Halifax, Riceville, Chatham, Callands, Rocky Mount, Keysville, and Charlotte Court House; the Virginia portions of South Hill, Boydton, Clarksville, and Draper; and approximately the northeast half of Martinsville and Endicott. This survey adjoins the eastern boundary of a previous one made in 1965, the results of which were published by the Division of Mineral Resources as Information Circular 12.

The purpose of this aeromagnetic survey is to provide basic information for interpretation of the geology and evaluation of mineral resources in the area. The maps are on open file in the Division's library at Charlottesville where they are available for reference use. Ozalid copies of the maps, available for purchase at a cost of \$5.00 per 15-minute quadrangle, may be ordered from the Virginia Division of Mineral Resources, Box 3667, Charlottesville, Virginia 22903.

ADDITION TO STAFF

Mr. John R. Algor joined the Division staff on October 1, 1969, and will assist in mapping metamorphic and igneous rocks of the Piedmont. He received his B.A. degree in geology from Antioch College in 1966 and his M.A. degree, specializing in petrology and geochemistry, from Princeton University this past June. During his undergraduate training Mr. Algor worked for the U. S. Geological Survey in California, Nevada, and Colorado and spent a year at the Université de Besançon, France, studying geology. During his graduate training Mr. Algor spent a summer doing reconnaissance geologic mapping in the northern coastal ranges of Venezuela under Princeton's Caribbean Research Program.

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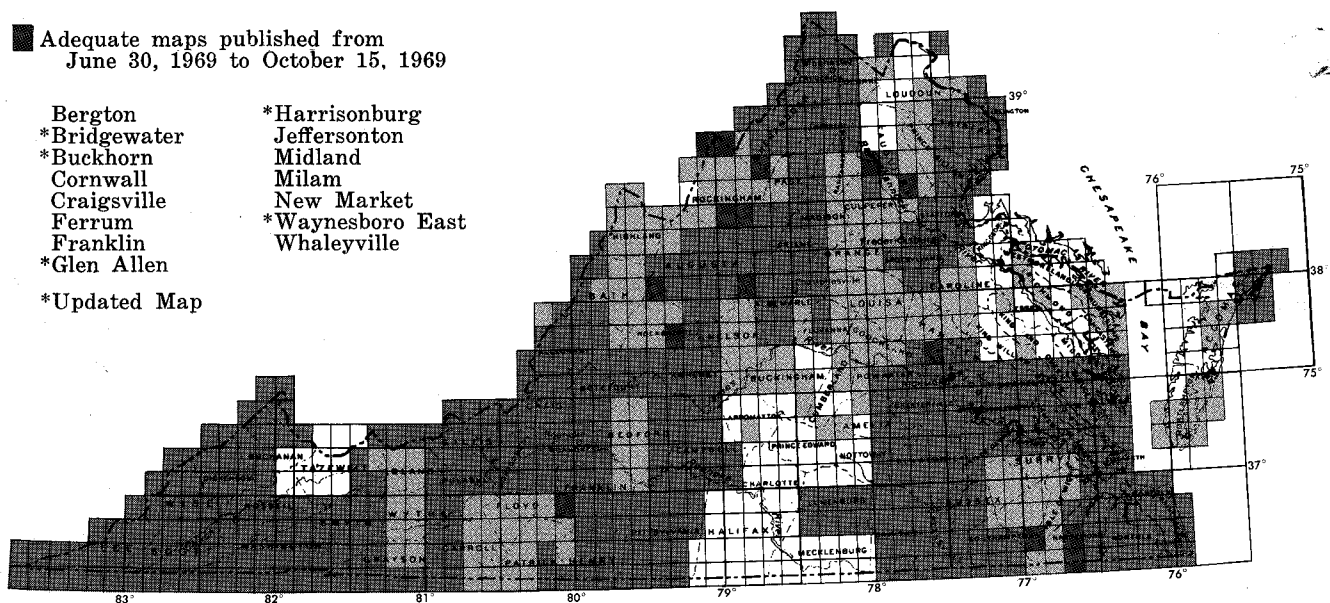
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Advance prints and copies of revision compilations are available at 50 cents each from the U. S. Geological Survey, Topographic Division, 1109 N. Highland St., Arlington, VA 22210.

PUBLISHED MAPS

State index is available free. Updated maps, on which recent cultural changes are indicated, are now available for certain areas of industrial, residential, or commercial growth. Published maps are available at 50 cents each from the Virginia Division of Mineral Resources, Box 3667, Charlottesville, VA 22903.

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